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## Relative feeding value of three forage-based diets for Holstein heifers

### Abstract

Soybeans interseeded with grain sorghum and harvested as a mixed forage silage crop can be used successfully as a feed for growing dairy heifers. However, daily gain is greater when grain sorghum silage plus alfalfa hay or prairie hay supplemented with milo grain and soybean meal is fed. Replacement heifer programs should be cost effective but yield a heifer large enough to be bred to calve by 24 months of age and with a well developed mammary gland relatively free of internal fat. A daily gain of 1.6 to 1.8 lbs appears to be optimum to achieve the desired bodyweight to be bred by 14 months of age. Feed cost to achieve the above physical goals often accounts for 60% of the total cost in a replacement heifer program. Forage may constitute the majority of a heifer's dry matter intake during the growing phase, if it supplies adequate energy, protein, mineral, and vitamins. Grain sorghum silage and prairie hay are abundant feed sources in Kansas and are frequently used in the diets of replacement heifers. However, grain sorghum is relatively low in protein, deficient in calcium, low in potassium, and potentially adequate in energy for growing heifers diets, whereas prairie hay is adequate in potassium, low in calcium and phosphorus, marginal in protein, and low in energy. Soybeans are well adapted to Kansas conditions and offer a forage that is abundant in protein, calcium, and potassium but relatively low in energy and phosphorus. Silage composed of a mixture of soybeans and grain sorghum should provide sufficient protein, energy, calcium, phosphorus, and potassium to meet the needs of growing dairy heifers. This trial was designed to ascertain the value of soybean-grain sorghum silage relative to sorghum silage or prairie hay as a feed for growing dairy heifers.; Dairy Day, 1987, Kansas State University, Manhattan, KS, 1987;

### Keywords

Kansas Agricultural Experiment Station contribution; no. 88-114-S; Report of progress (Kansas Agricultural Experiment Station); 527; Dairy; Replacement heifers; Soybean meal; Grain sorghum; Milo grain

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## RELATIVE FEEDING VALUE OF THREE FORAGE-BASED DIETS FOR HOLSTEIN HEIFERS

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J.E. Shirley, J.L. Morrill, and W.H. Carinder

### Summary

Soybeans interseeded with grain sorghum and harvested as a mixed forage silage crop can be used successfully as a feed for growing dairy heifers. However, daily gain is greater when grain sorghum silage plus alfalfa hay or prairie hay supplemented with milo grain and soybean meal is fed.

### Introduction

Replacement heifer programs should be cost effective but yield a heifer large enough to be bred to calve by 24 months of age and with a well developed mammary gland relatively free of internal fat. A daily gain of 1.6 to 1.8 lbs appears to be optimum to achieve the desired bodyweight to be bred by 14 months of age. Feed cost to achieve the above physical goals often accounts for 60% of the total cost in a replacement heifer program. Forage may constitute the majority of a heifer's dry matter intake during the growing phase, if it supplies adequate energy, protein, mineral, and vitamins.

Grain sorghum silage and prairie hay are abundant feed sources in Kansas and are frequently used in the diets of replacement heifers. However, grain sorghum is relatively low in protein, deficient in calcium, low in potassium, and potentially adequate in energy for growing heifers diets, whereas prairie hay is adequate in potassium, low in calcium and phosphorus, marginal in protein, and low in energy. Soybeans are well adapted to Kansas conditions and offer a forage that is abundant in protein, calcium, and potassium but relatively low in energy and phosphorus. Silage composed of a mixture of soybeans and grain sorghum should provide sufficient protein, energy, calcium, phosphorus, and potassium to meet the needs of growing dairy heifers. This trial was designed to ascertain the value of soybean-grain sorghum silage relative to sorghum silage or prairie hay as a feed for growing dairy heifers.

### Procedures

Seventy-two Holstein heifers were sorted into light and heavy weight groups and distributed among treatment groups according to age and body weight. Treatment groups were soybean-grain sorghum silage (S-GSS), grain sorghum silage plus alfalfa hay (GSS-AH), and prairie hay (PH). Each treatment group contained two replications (one light and one heavy), with 12 head per replication.

Forages were supplemented with milo and soybean meal in a ratio to provide isocaloric and isonitrogenous diets. Calcium, phosphorus, potassium, trace

mineral salt, and Rumensin were balanced across treatment groups. Trace mineral salt was also provided free choice.

All animals were introduced to the appropriate treatment for 1 week prior to the experiment. Heifers were fed to gain 1.6 lbs per day over the 97-day experimental period. Experimental rations (Table 1) were adjusted for growth one time during the trial. Ten percent feed above requirements was fed daily to provide room for growth between the major feed adjustment periods.

Soybeans and grain sorghum were interseeded at the rate of 100 lbs of soybeans and 20 lbs of grain sorghum per acre with a grain drill. The mixture was harvested when the grain sorghum reached the early dent stage and ensiled in a concrete stave silo until fed.

Table 1. Experimental rations<sup>1</sup>

Treatment	Light Heifers <sup>2</sup>		Heavy Heifers <sup>3</sup>	
	DM <sup>4</sup>	As Fed <sup>5</sup>	DM	As Fed
-----lbs per head per day-----				
A. S-GSS				
Soybean-G. Sorg. Sil.	13.0	26.26	16.45	33.24
Milo carrier <sup>6</sup>	2.41	2.74	1.74	1.98
B. GSS-AH				
Sorghum sil.	7.50	17.13	8.63	19.72
Alfalfa hay	6.61	7.72	8.27	9.66
Milo carrier	1.10	1.25	1.10	1.25
Dicalcium phosphate	.05	.055	.063	.066
Calcium carbonate	.008	.009	.0275	.0275
Potassium chloride	.04	.044	.088	.088
C. PH				
Prairie hay	10.45	12.00	12.30	14.13
Milo carrier	1.10	1.25	1.10	1.25
Milo	3.30	3.75	3.21	3.65
Soybean meal	1.95	2.19	2.28	2.56
Dicalcium phosphate	.077	.077	.077	.077
Calcium carbonate	.055	.055	.066	.066
Potassium chloride	.286	.286	.341	.341

<sup>1</sup> Rations shown are the initial rations which were adjusted to allow for increased heifer weight over time.

<sup>2</sup> Light heifers — initial weight less than 700 lbs.

<sup>3</sup> Heavy heifers — initial weight greater than 700 lbs.

<sup>4</sup> DM = dry matter basis.

<sup>5</sup> As fed = as fed basis.

<sup>6</sup> Milo carrier — ground milo was used as a carrier for rumensin, salt, and vitamins.

### Results and Discussion

Holstein heifers fed grain sorghum silage plus alfalfa hay gained more weight per day (2.2 lbs) than those fed prairie hay plus milo grain and soybean meal (2.0 lbs) or soybean-grain sorghum silage alone (1.5 lbs; Table 2). However, heifers fed soybean-grain sorghum silage appeared to increase in wither height more than heifers on the other diets. This suggests that sufficient nutrients were available in the soybean-grain sorghum diet to support a desirable growth rate without excess body fat accumulation. Apparently, the additional body weight gain (above 1.5 lbs per day) observed in heifers fed grain sorghum silage plus alfalfa hay and those fed prairie hay supplements with milo grain and soybean meal was due to fat accumulation rather than skeletal growth.

Data in this report are from one study and will be supplemented with an identical study during the winter of 1987-88. Conclusions drawn at this time are preliminary and should be treated as such.

Table 2. Weight gain and wither height change of Holstein heifers fed various forage-based diets for 97 days

Diet	Daily Gain	Change in Wither Height
Soybean-Grain Sorghum Silage	1.5 lbs	1.5 inches
Sorghum silage plus alfalfa hay	2.2 lbs	1.25
Prairie hay plus milo grain and soybean meal	2.0 lbs	1.34